REMARKS

This amendment is responsive to the Office Action of April 3, 2007. Reconsideration and allowance of claims 1-20 are requested.

The Office Action

Claims 1-10 and 15-18 stand rejected under 35 U.S.C. § 102(b) as being anticipated by Hinks (US 6,294,913) and under 35 U.S.C. § 112, second paragraph.

Claims 11-14 stand rejected under 35 U.S.C. § 102 as being anticipated by Hinks, under 35 U.S.C. § 112, second paragraph, and under 35 U.S.C. § 101.

The Hinks Reference

Hinks, the acknowledged prior art referenced at page 1, line 16 of the present application, is concerned with magnetic field fluctuations, such as caused by passing vehicles (column 5, lines 1-9). This is preferably done by exciting a separate sample with a separate RF excitation coil (column 5, lines 51-53). Alternately, the monitoring can be done by applying RF signals with a very small flip angle interleaved with the imaging sequences. However, the flip angle should be reduced to a very small value so as not to unduly affect the spin magnetization of the subject being imaged (column 5, lines 55-60). In a third alternative, the signal is monitored after excitation but prior to the application of a readout gradient or a phase-encode gradient (column 5, line 61 - column 6, line 5). Thus, in each embodiment, the portion of the magnetic resonance monitored for frequency correction is different from the portion of the magnetic resonance signal acquired for image reconstruction. Once the frequency shift attributable to magnetic field variations is acquired, this frequency variation is used to compensate the acquired image data (column 6, lines 52-53). In Figure 6, Hinks describes a retrospective compensation technique in which the frequency error is determined and, based on the frequency error, a phase correction is made to each of the already acquired magnetic resonance signals (column 7, lines 14-44).

The Present Application

The present application focuses on a prospective magnetic field drift compensation technique in which the phase of the magnetic resonance signal corresponding to each k=0 or zero phase-encoded data line in an EPI or gradient echo sequence is compared. More specifically, the phase shift between the two k=0 data line samplings is divided by 2π times the time difference between excitation and the acquisition of each of the two echoes. Based on the determined phase shift, either the strength of the magnetic field is adjusted or the frequency of the magnetic resonance excitation pulse will be adjusted before commencement of the next gradient echo or EPI sequence.

The Claims Distinguish Patentably Over the References of Record

Claim 1 calls for acquiring a first magnetic resonance signal which corresponds to a central k-space line a first echo time after a first excitation and a second magnetic resonance signal corresponding to the central k-space data line a second echo time after a second excitation. Hinks also generates similar magnetic resonance signals, but for use in reconstructing a diagnostic image(s). Claim 1 goes on to call for determining shift of resonance frequency based on a difference of the first and second magnetic resonance signals corresponding to the central k-space line and the first and second echo times. Hinks does not suggest using this image data and the echo times at which it was collected for determining a shift of resonance frequency. Claim 1 emphasizes that the same data which is used to compensate for magnetic field drift distortion is also used in generating a magnetic field drift compensated image.

In this manner, claim 1 sets forth a method in which MR images are compensated for magnetic field drift, which method is more efficient than the Hinks method. Note that no additional data need be generated or acquired.

Accordingly, it is submitted that **claim 1 and claims 2-6 and 8-10** are not anticipated by Hinks.

Claim 7 calls for generating first and second magnetic resonance echoes at first and second echo times which both correspond to a selected one of the k-space data lines. Based on the phase of the first and second echoes and the first and second

echo times, the magnetic field drift is determined. Hinks does not disclose determining magnetic field drift based on the differences in the phases and the echo times of first and second echoes.

Moreover, claim 7 calls for compensating for the magnetic field drift by adjusting the magnetic field. Hinks does not suggest adjusting the magnetic field.

Further, claim 7 calls for generating an image from the magnetic resonance echoes at least partially collected with the adjusted magnetic field in order to compensate for magnetic field drift. Again, Hinks does not disclose constructing magnetic resonance images using an adjustable magnetic field.

Accordingly, it is submitted that claim 7 is not anticipated by Hinks.

Claim 11 has been amended as suggested by the Examiner to include a tangible result, specifically reconstructing a diagnostic image. Claim 11 further calls for the diagnostic image to be generated from the signals which correspond to the preselected line of k-space (and others) that was used in the calculations to determine a shift of the resonance frequency. Such a computer product is not shown or fairly suggested by Hinks. Accordingly, it is submitted that **claim 11 and claims 12-14 and 19 dependent therefrom** are not anticipated by Hinks.

Claim 15 calls for determining a first phase of a first occurrence of a preselected line of k-space and a second phase of a second occurrence of the preselected line. The resonance frequency shift is calculated based on the difference of the first and second phases and this time interval. Hinks does not teach or disclose such a calculation for resonance frequency shift. Claim 15 further calls for reconstructing an image from a plurality of the lines of k-space compensated for resonance frequency phase shift.

Accordingly, it is submitted that **claim 15 and claims 16-18 dependent therefrom** are not anticipated by Hinks.

CONCLUSION

For the reasons set forth above, it is submitted that claims 1-20 are not anticipated by Hinks and meet all statutory requirements. An early allowance of all claims is requested.

In the event the Examiner considers personal contact advantageous to the disposition of this case, he is requested to telephone Thomas Kocovsky at (216) 861-5582.

Respectfully submitted,

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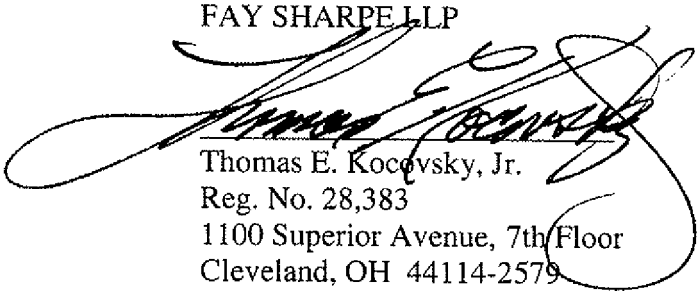

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